

MACROINVERTEBRATE AND FISH COMMUNITY ASSESSMENT
ON TWO UNNAMED TRIBUTARIES OF HAWE CREEK NEAR
THE NEVADA GOLDFIELDS, INC. BARITE HILL PROJECT,
McCORMICK COUNTY, SOUTH CAROLINA

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Submitted To:

NEVADA GOLDFIELDS, INC.

McCormick, South Carolina

Submitted By:

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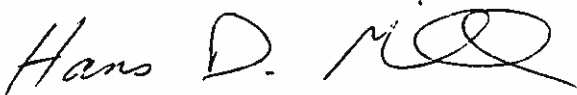
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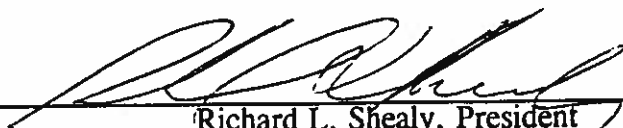
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I. SUMMARY

An assessment of the fish and macroinvertebrate community of the two unnamed tributaries of Hawe Creek, McCormick County, South Carolina, which receive drainage from the Barite Hill Project operated by NEVADA GOLDFIELDS, INC. was conducted by SHEALY ENVIRONMENTAL SERVICES, INC. on February 26 and March 1, 1993. The results of this assessment indicated the two streams support relatively diverse fish and macroinvertebrate communities.

The results of this study indicate a substantial increase in species richness and abundance of the macroinvertebrate community at all stations approaching those found in February 1992. The fish population was most numerous and diverse at Station 2B. This station also showed a slight reduction in EPT richness and abundance. We feel that these results are most likely correlated. Both streams appeared diverse and well balanced and no toxic effects could be determined from this assessment.

The water chemistry parameters (temperature, dissolved oxygen, pH and conductivity) measured in conjunction with this assessment indicated that no impact has occurred due to the operation on the mine and that all parameters measured were within the standards for class B waters established by the state of South Carolina.

II. INTRODUCTION

On February 26 and March 1, 1993, SHEALY ENVIRONMENTAL SERVICES, INC. (SCDHEC Laboratory Certification No. 26103) conducted a fish and macroinvertebrate community assessment on two unnamed tributaries of Hawe Creek, which are potentially impacted by the Barite Hill Project operated by NEVADA GOLDFIELDS, INC. The objective of this study was to determine the present condition of the stream communities.

III. DESCRIPTION OF STUDY AREA

Collections of fish and macroinvertebrates were made from an upstream and downstream site on each of the two streams (Figure 1). At all stations sand, silt, cobble and stones composed the substrate and algae was the predominant vegetation. Station 1A served as the reference site for stream A. The stream at this location flows through a mixed hardwood forest and is approximately 1.5 to 2.5 meters wide with a depth 0.5 meters in the riffle areas and 0.75 meters in the pools.

Station 2A was located approximately one hundred meters downstream of the mine site. The stream at this location was similar to the reference site with alternating shallow riffle areas and 0.5 - 1.0 meter deep pools.

Station 1B served as the reference site for stream B. The stream at this location flowed through a mixed hardwood forest. This stream was similar to stream A in physical characteristics with a width of 1.0 to 2.5 meters. The depth ranged from 0.1 meters in the riffle areas to 1.0 meters in the pools. Station 2B was located approximately 20 meters downstream of the confluence with a small order first branch running parallel to the mine site. The characteristics were essentially the same as those of station 1B, with alternating shallow riffle areas and pools.

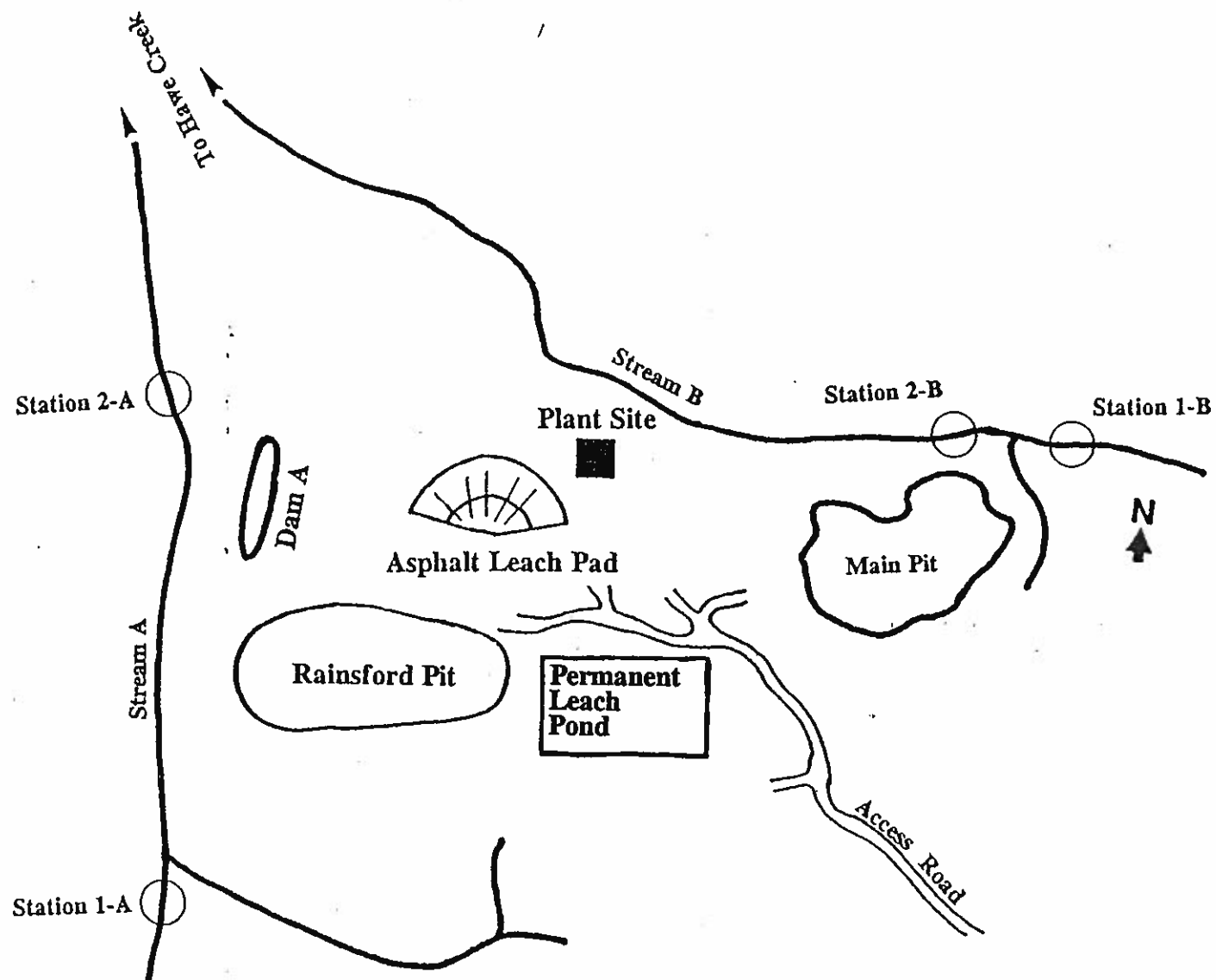


Figure 1. Sampling station on the two unnamed tributaries of Hawe Creek receiving drainage from the Barite Hill Project operated by NEVADA GOLDFIELDS, INC., McCormick County, South Carolina.

IV. METHODS AND MATERIALS

Qualitative collections of aquatic macroinvertebrates were made with a D-frame aquatic dip net, a U.S. Standard no 30 sieve, and by hand picking organisms from substrates with forceps. The multiple habitat approach, where specimens from all available habitats (stream margins, leaf packs, aquatic vegetation, water-soaked logs and sand deposits) are pooled to form one aggregate sample was utilized as the sampling procedure. Samples were preserved in the field with 70% Ethanol. Sampling procedures and habitat types were kept similar at each station to enable species and numerical population comparisons between stations.

Fish sampling was conducted by a two-person team using a Coffelt Model Mark 10 Backpack Electrofisher. Sampling was conducted along a 100 m length of stream. Shocking times were kept at 900 seconds at all sampling locations to enable species and numerical population comparisons between stations.

Water chemistry parameters taken at each station in conjunction with the macroinvertebrate sampling were: pH (Orion Model 290A), water temperature (stick thermometer), conductivity (Yellow Springs Instrument Model 33), and dissolved oxygen (Yellow Springs Instrument Model 57).

Upon return to the laboratory, macroinvertebrate collections were sorted from debris with the aid of a stereo microscope. The macroinvertebrates were identified to the lowest positive taxonomic level and counted with the aid of appropriate microscopic techniques and taxonomic keys (see Appendix A) by Mr. Dave Lenat. All macroinvertebrates collected will be maintained in SHEALY ENVIRONMENTAL SERVICES, INC.'s voucher collection for three years or placed into our permanent reference collection.

Comparison of the macroinvertebrate communities was based on changes in taxonomic composition between stations and on known tolerance levels and life history strategies of the organisms encountered. To facilitate data analysis, the USPEA's rapid bioassessment protocol III was utilized. This method uses a series of metrics calculated for the stations downstream from the discharge point and compared the results with an upstream control site (USEPA, 1989). These metrics are listed in Table 2 and include: 1) taxa richness or the number of different taxa found at a particular station, which is a measure of diversity; 2) EPT index, the number of taxa from the insect orders Ephemeroptera, Plecoptera, and Trichoptera found at a station. These three insect orders are considered to be generally intolerant of adverse water quality conditions, and therefore, a reduction in these taxa is indicative of reduced water quality; 3) ratio of EPT and Chironomidae abundance, uses relative abundance of these indicator groups as a measure of community balance, good biotic condition is reflected in communities having fairly even distribution among these four groups; and 4) percent contribution of dominant taxon, an indication of community balance, a community dominated by relatively few species is indicative of environmental stress.

V. RESULTS AND DISCUSSION

A. Physicochemical Analysis

The water chemistry data taken in conjunction with the fish and macroinvertebrate collections are given in Table 1. None of the measured parameters (temperature, dissolved oxygen, pH and conductivity) appear to be affected by the operation of the mine and all were within the standards for Class B waters established by the state of South Carolina.

Table 1. Physicochemical data collected from two unnamed tributaries of Hawe Creek Near the NEVADA GOLDFIELDS, INC.'s. Barite Hill Project February - March 1993.				
Parameters	Stream A		Stream B	
	1	2	1	2
Water Temp. (°C)	5.0	4.5	6.0	7.5
pH (SU)	7.30	7.20	7.30	7.50
Conductivity (umhos/cm)	100	80	105	90
Dissolved Oxygen (mg/l)	13.0	12.6	11.5	10.8

B. Fish Community Analysis

The results of the fish community analysis are presented in Table 2. A total of 343 specimens representing 8 taxa were recorded from the two streams. The data reflects the low species diversity and the relatively low numbers of specimens generally found in small first and second order coastal plains streams. A total of 6 species were recorded from Stream A, with 20 specimens representing 3 taxa from Station 1A, and 17 specimens representing 6 taxa from Station 2A. A total of 8 species were collected from Stream B, with 95 specimens representing 4 species from Station 1B and 211 specimens representing 8 species from Station 2B. The data reflects little or no impact on the species composition of the two streams. The lower numbers of individuals collected from Stream A, may be the result of variation in the distribution of the stream's fish populations.

Table 2. Fish species and number of specimens collected in conjunction with the instream community assessment of two unnamed tributaries of Hawe Creek near the Barite Hill Project, NEVADA GOLDFIELDS, INC., McCormick County, South Carolina.

	Stations			
	1-A	2-A	1-B	2-B
Catostomidae				
<i>Erimyzon oblongus</i> (Creek Chubsucker)		1		1
Centrarchidae				
<i>Lepomis macrochirus</i> (Bluegill)	1	1	4	2
<i>Lepomis cyanellus</i> (Green Sunfish)	6	8	2	2
<i>Lepomis microlophus</i> (Redear Sunfish)				5
<i>Lepomis auritus</i> (Redbreast Sunfish)				2
Cyprinidae				
<i>Clinostomus funduloides</i> (Rosyside Dace)	13	4	71	173
<i>Nocomis leptocephalus</i> (Bluehead Chub)		2	18	22
Ictaluridae				
<i>Ictalurus natalis</i> (Yellow Bullhead)		1		4
TOTAL/STATION	20	17	95	211
TOTAL/STREAM		37		306
TOTAL SPECIES/STATION	3	6	4	8
TOTAL SPECIES/STREAM		6		8

C. Macroinvertebrate Community Analysis

The results of the macroinvertebrate community analysis are presented in Table 3. A total of 245 specimens representing 42 taxa were collected from Stream A and a total of 253 specimens representing 31 taxa were collected from Stream B. Both species richness and abundance were significantly increased from the September 1992 assessment.

Stream A

The reference site (Station 1A) yielded 118 specimens representing 24 taxa. An EPT richness of 11 was calculated for this station. The Chironomidae were represented by 6 taxa. The dominant taxon was the *Orthocladius clarkei* group which represented 55% of the specimens collected.

The study site (station 2A) yielded 137 specimens representing 33 taxa. An EPT richness of 16 was calculated for this station. The Chironomidae were represented by 8 taxa. The dominant taxon was *Stenonema femoratum* which contributed 17% of the specimens.

Stream B

The reference site (station 1B) yielded 132 specimens representing 23 taxa. An EPT richness of 13 was calculated for this station. The Chironomidae were represented by 1 taxon. The dominant taxon was *Stenonema modestum* which contributed 44% of the specimens collected.

The study site (station 1B) yielded 121 specimens representing 19 taxa. An EPT richness of 9 was calculated for this station. The Chironomidae were represented by 2 taxa. The dominant taxon was *Stenonema modestum* which contributed 32% of the specimens collected.

IV. CONCLUSIONS

The results of the fish and macroinvertebrate community analyses indicate little or no impact has resulted from the operation of the Barite Hill Project on the two streams receiving drainage from the mine site. Both streams exhibit increased species richness and abundance when compared to the September 1992 assessment. Fish abundance and diversity was greatest at Station 2B which may have caused the slightly lower EPT richness and abundance at this station due to natural predatory influence. The relatively high abundance of EPT species is indicative of the good water quality conditions of the two tributaries of Hawe Creek at the Barite Hill Gold Mine.

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Table 3. Macroinvertebrates collected from two unnamed tributaries (Streams A and B) of Hawe Creek near the Barite Hill Project, February - March 1993.

Organism	Sample ID:	STATIONS			
		1-A 36560	2-A 36561	1-B 35831	2-B 35832
EPHEMEROPTERA					
<i>Acentrella amplus</i>		2	2	7	
<i>Acerpenna pygmaeus</i>		2	8	1	1
<i>Ameletus lineatus</i>				3	
<i>Caenis</i> sp.		1			
<i>Habrophlebia vibrans</i>					5
<i>Leptophlebia</i> sp.				2	
<i>Paraleptophlebia</i> spp.			3		
<i>Stenoonema femoratum</i>		6	23	5	
<i>Stenonema modestum</i>		1	16	58	39
<i>Stenacron interpunctatum</i>				5	12
	Total	12	52	81	57
PLECOPTERA					
<i>Allocapnia</i> sp.			1	1	
<i>Amphinemura</i> sp.		3	4	1	5
<i>Eccoptura xanthenes</i>		1			
<i>Perlesta placida</i>			2		
	Total	4	7	2	5
TRICHOPTERA					
<i>Cheumatopsyche</i> spp.		4	10		7
<i>Chimarra</i> sp.			3		1
<i>Diplectrona modesta</i>			1	3	
<i>Hydatophylax argus</i>					1
<i>Hydropsyche betteni</i>		4	5		
<i>Ironoquia punctatissima</i>		1			
<i>Neophylax</i> spp.			1	2	
<i>Polycentropus</i> sp.		1	1		
<i>Pycnopsyche</i> sp.			1	2	1
<i>Rhyacophila ledra</i>			2	1	
	Total	10	24	8	10
COLEOPTERA					
<i>Anchytarsus bicolor</i>			1		
<i>Helichus</i> sp.			13	3	2
<i>Hydroporus</i> sp.			1		
	Total	0	15	3	2
ODONATA					
<i>Argia</i> sp.		1			
<i>Calopteryx</i> sp.				1	2
<i>Stylogomphus albistylus</i>					2
	Total	1	0	1	4

Table 3. Continued

Organism	SAMPLE ID:	STATION			
		1-A 36560	2-A 36561	1-B 35831	2-B 35832
DIPTERA: CHIRONOMIDAE					
C/O sp.10 (<i>Orthocladius obumbratus</i> gr.)		1	4		
C/O sp.12 (<i>Orthocladius clarkei</i> gr.)		65	13		
<i>Conchapelopia</i> group			5		
<i>Diamesa</i> sp.		4			5
<i>Diplocladius cultriger</i>		1			
<i>Hydrobaenus</i> sp.		2			
<i>Larsia</i> sp. (?)				1	
<i>Natarsia</i> sp.			1		
<i>Polypedilum convictum</i>			2		
<i>Polypedilum fallax</i>			2		
<i>Parametriocnemus lundbecki</i>		1			
<i>Rheotanytarsus</i> sp.			1		
<i>Tanytarsus</i> sp.			1		
<i>Tvetenia bavarica</i> gr.					1
Total		74	29	1	6
MISC. DIPTERA					
<i>Hexatoma</i> sp.			1		
<i>Simulium</i> spp.		2	2	17	27
<i>Tipula</i> spp.		4	3	1	
Total		6	6	18	27
OLIGOCHAETA					
Cambarincolidae					1
Lumbriculidae		1	1	2	
Opisthopora				1	
Total		1	1	3	1
CRUSTACEA					
Astacidae		1	1		
<i>Cambarus</i> spp.				2	1
<i>Crangonyx</i> sp.		3	2	5	6
<i>Lirceus</i> sp.		6		8	2
Total		10	3	15	9
Total Taxa Richness		24	33	23	19
Total Abundance		118	137	132	121
EPT Richness		11	16	13	9
EPT Abundance		26	83	91	72
Chiromidae Richness		6	8	1	2
Chironomid Abundance		74	29	1	6
EPT/Chironomidae Abundance		0.35	2.86	13	12
Percent Dominant Taxon		55	17	46	32

APPENDIX A: Taxonomic Keys used in the identification of freshwater fishes and macroinvertebrates.

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